JUNE 23RD, 1856.

JAMES HENTHORN TODD, D.D., PRESIDENT, in the Chair.

ROBERT PATTERSON, ESQ., was elected a Member of the Academy.

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The President exhibited the original Captain's commission, granted in the reign of James II. to the great-grandfather of Michael Warren, Esq.

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Professor Hennessy read a Paper on the influence of the earth's internal structure on the length of the day.

Having stated that changes in the distribution of the matter composing the interior of the earth will generally tend to alter its velocity of rotation, and thus vary the length of the day, the author proceeded to examine the probable nature of such changes. Laplace had already examined the effect of the cubical contraction of the globe considered as a cooling solid;* but if the earth consists of a solid shell filled with matter in a state of fluidity, the inquiry assumes a different shape. Hitherto this, as well as all other questions connected with the general structure and rotation of the earth, had been treated on the assumption that the particles of the fluid underwent no changes in their positions on assuming the solid state. In his "Researches in Terrestrial Physics,"† Mr. Hennessy had pointed out the necessity of abandoning this assumption, and he, moreover, investigated what would be the internal structure of the earth on the supposition that it consists of matter possessing a recognised property of the igneous rocks at its surface—namely, of contracting in volume

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* Mecanique Celeste, Livre XL. † Philosophical Transactions, 1851, Part II.

on passing from the fluid to the solid crystalline state. After the first formation of a solid shell, all the succeeding additions to its inner surface occurring by contraction from within outwards, the tendency of the process of solidification must be to lessen the pressure on the nucleus. If the increasing density of the nucleus towards its centre be due to pressure, it must follow that its mean density will be diminished by the removal of pressure from its surface; it will therefore tend to expand, and become more homogeneous. The moment of inertia of the earth will be thus directly increased; and, supposing the shell and nucleus to move as one mass, which appears to result from one of the following conclusions, as well as from the probable nature of the matter of which they are composed, a cause will exist for increasing the length of the day. But the changes referred to will also cause the surface of the nucleus to gradually become more oblate, and, consequently, each successive stratum of solidified matter added from it to the shell. The strata of the shell will therefore increase in oblateness from its outer to its inner surface, while those of the nucleus will still continue to decrease from its surface to its centre, although not always according to the same law. From this conclusion two others are deduced:—1. The existence of great pressure and friction at the surface of contact of the solid and fluid; for otherwise, according to a result obtained by Mr. Hopkins, the precession of the equinoxes would greatly differ from that which is observed.* 2. The moment of inertia corresponding to the earth's axis of rotation would be increased independently of the cause already mentioned, which would increase all the moments of inertia of the earth. This result had been already used by Mr. Hennessy, in the memoirs referred to, and also in a letter to Sir John Lubbock,† to prove the continued stability of the earth's axis

* Phil. Trans. 1840, p. 207; also, Phil. Trans. 1851, vol. ii., p. 546.

† Proceedings of the Royal Society, February, 1852.

during all geological epochs, as well as at the present day. He now applied it to the question under discussion, wherein it made the proposition more manifest, that the tendency of change of state of the matter composing the interior of the earth, in passing from fluidity to solidity, would be to increase the length of the day. At the same time the slow cubical contraction of the entire mass, due to its gradual loss of internal heat, would tend to accelerate the velocity of rotation, and to diminish the length of the day. Both of these opposing tendencies depend upon a common cause—the secular refrigeration of the earth. This, from the investigations of Fourier and Laplace, has been shown to be so extremely slow, that if only one of these counteracting tendencies existed alone, it would be difficult to detect its influence on the earth's rotation; but when their simultaneous opposition is taken into account, it should not excite surprise that astronomical observations have hitherto never disclosed any variation in the length of the day, and ages may possibly elapse before any such variation shall be discovered.

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Mr. J. Huband Smith exhibited to the Academy a rubbing taken from the ancient cross in the market-place at Campbellton, in Kyntire, with a restoration, upon an enlarged scale, of the inscription upon it, as follows:—

HÆC ⁝ EST ⁝ CRVX ⁝ DOMINI ⁝ YVARI ⁝ M ⁝ HEACHYRNA ⁝ QVŌDAM ⁝ RECTORIS ⁝ DE ⁝ KYL ⁝ REACAN ⁝ ET ⁝ DOMINI ⁝ ANDREA ⁝ NATI ⁝ EIUS ⁝ RECTORIS ⁝ DE ⁝ KIL ⁝ COMAN ⁝ QVI ⁝ HANC ⁝ CRUCEM ⁝ FIERI ⁝ FACIEBAT ⁝

This inscription, in tolerably good preservation, is in raised characters of the fifteenth century, in low relief, and is placed about the middle of the shaft of the cross, which occupies a conspicuous position in the centre of the town. It is formed of a single stone, of dark-coloured compact limestone, about 9 feet in height; nearly 2 feet across the arms; 15 inches in